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Ground Beef Oxidation is inhibited by Soluble Fraction of Mushroom

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Objectives

Oxidation is a major contributor to degradation of color and flavor in ground beef. Mushrooms have been shown to inhibit lipid oxidation when added to meat products. One of the major components in mushrooms that acts as an antioxidant is Ergothioneine, a compound that works as a free radical scavenger. The objective of this study was to evaluate the impact of mushroom addition to ground beef patties on lipid and protein oxidation, cohesiveness, and color.

Materials and Methods

In addition to a control containing no mushrooms, 4 treatments were used; chopped, whole mushroom; dried mushroom powder; aqueous extract; and residue remaining after extraction. Half of the patties for each treatment were packaged in aerobic over-wrap packaging while the remaining patties were packaged using modified atmosphere packaging (MAP) containing 70% nitrogen, 30% CO₂, and 0.4% carbon monoxide. Patties were stored in a cooler at approximately 36°F for 4 d, cooked, and tested by Thiobarbituric acid (TBA) assay for lipid oxidation, Dinitrophenyl hydrazine (DNPH) assay for protein oxidation, and resistance to tear (RTT) for cohesiveness. Patty color was measured daily during storage by Hunter L*a*b* using a colorimeter (Minolta CR-300 series). All statistical analyses were performed using Statistical Analysis Software (SAS; SAS Inst. Inc., Cary, NC).

Results

Lipid oxidation levels were significantly ($p < 0.05$) lower for the aerobic and MAP whole, powder, and ex-

tract samples compared to the aerobic control. Patties with mushroom residue in both packaging treatments had significantly higher levels of lipid oxidation than other mushroom treatments and the control. After 4 d, MAP patties exhibited significantly lower a*(redness) values than those packaged aerobically with the exception of the aerobically packaged mushroom powder treatment, which also had significantly lower redness compared to the aerobic treatments. Although the results were not significant, a trend can be seen among the data showing that patties treated with whole mushroom or residue tend to have lower redness values. Free carbonyls and cohesiveness did not differ among mushroom or packaging treatments. There were no observed differences ($p = 0.4581$) in protein oxidation among treatments, indicating mushrooms may preferentially inhibit pathways for lipid oxidation rather than protein oxidation. There were also no observed differences among treatments for patty cohesiveness ($p = 0.875$).

Conclusion

In conclusion, adding whole, powdered or extracted mushroom inhibits lipid oxidation in ground beef patties, but does not significantly affect protein oxidation or cohesiveness. Although powdered mushroom effectively inhibits lipid oxidation, it triggers pigment oxidation causing patties to become an undesirable brown color rather. Among the treatments used, the most suitable for commercial production would be the mushroom extract because it significantly lowered lipid oxidation while allowing the patties to retain a bright cherry red color. In the future, sensory testing is needed to determine if consumer perception matches the laboratory results.